

## ORIGINAL ARTICLE

## Epidemiology of Acute Lower Respiratory Tract Infections in Children

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## ABSTRACT

**Background:** Lower respiratory tract infections attack the airways below the larynx, including the trachea and alveolar sacs. It is related to infants and young children more frequently.**Purpose:** Therefore, this study was conducted on children less than five years to determine their LRTI epidemiological trends.**Methods:** The study comprised 761 children up to 5 years old who were presented at the outpatient department (OPDs) and were admitted to Tertiary care hospitals in district Dera Ismail Khan, Lakki Marwat and Tank from January 2022 to January 2023.**Results:** The study included 488 boys (64.12%) and 273 girls (35.87%), diagnosed with LRTIs. Our findings revealed that the LRTI showed the highest incidence in infants ( $p < 0.05$ ) with less than a year of age (327/761). Female children (57.03) in our study were most often infected ( $p < 0.05$ ) with LRTIs than males (42.96%), respectively. Significantly lower-weighted children were more prone to the infection ( $p < 0.05$ ) of weight less than 10 Kg with an incidence of 64.52% and a high proportion ( $p < 0.05$ ) of the infected kids belonged to poor families (85.41%) of mostly ( $p < 0.05$ ) rural area (60.84%). The clinical manifestations were characterized by coughing (93.95%), followed by fever (78.97), phlegm (70.95%), tight chest (42.96%), shortness of breath (36.92%), dyspnea (15.90%) and 14.06% (107/761) children manifested with wheezing sounds during infection.**Conclusion:** It was concluded that infants had the highest frequency of LRTIs rendering them to hospitalization.**Practical Implications:** Therefore, public intervention to prevent LRTIs in children should be implemented prior to the seasonal spread of infectious diseases.**Keywords:** Coughing; Dyspnea; Epidemiology; Phlegm; Wheezing.

## INTRODUCTION

Lower respiratory tract infections (LRTIs) consist of bronchiolitis, bronchitis, lung abscess, pneumonia and tuberculosis. Many LRTIs are viral, while some are bacterial in origin. LRTIs are characterized by coughing, tiredness, tight chest, shortness of breath or dyspnea, weakness, and pyrexia and are the greatest cause of death in children worldwide. LRTIs accounted for around 11.9 million hospitalized young children worldwide and are a leading cause of death in children 2 years of age and resulting in 6.8% of fatalities in newborns<sup>1</sup>.

The frequency of LRTIs among children under 5 years old has been estimated to be 12,197.8 per 100,000 children worldwide. These are the main cause of hospitalizations among children. Notably, pneumonia ranks among the top 10 conditions in terms of hospitalization costs and is shown to affect 0.22 children every year in developing nations. The Global Burden of Disease Study 2017 reported that LRTIs caused 808920 deaths in children younger than 5 years, irrespective of sex<sup>2</sup>.

Environmental risk factors have a significant impact on the incidence of LRTIs in children. Nonexclusive breastfeeding, low birth weight, malnutrition, lack of measles vaccination in children below one year of age, zinc and vitamin A deficiency, concomitant diseases (e.g. heart disease, asthma, and diarrhea), mother's literacy level, poor socio-economic status, parental smoking, air pollution, indoor crowding, humidity and cold weather are the most significant risk factors. In many countries, the frequency of deaths attributable to LRTIs has decreased as a result of the accessibility of antibiotics, improvements in the nutritional quality of children and the immunization rate<sup>3</sup>. These risk factors in infants fluctuate with their age. Maternal food and nutritional health play a significant outcome in early infancy (0–6 months) by influencing breast milk quality and output and restricting milk antibody transmission. Thereafter, the kid gets more exposed to the external world, and it is believed that water, sanitation and hygiene (WASH) and other environmental elements exert a greater influence<sup>4</sup>.

LRTIs impose a substantial strain on patients, their families, and the budgets of public healthcare systems. The World Health Organization (WHO) created the Global Action Plan for the Prevention and Control of Pneumonia (GAPP) in 2009 to increase pneumonia and provide logistical direction in order to reduce the

morbidity and mortality of pneumonia in children under 5 years old<sup>2</sup>.

As, thorough data on age-specific risk factors in children younger than two years old are rare and LRTIs are significant determinants of child mortality, understanding their epidemiological distribution in Khyber Pakhtunkhwa is essential for developing focused intervention measures. In this study, we investigated the epidemiology of LRTIs in children under 5 years old in Khyber Pakhtunkhwa.

## MATERIALS AND METHODS

**Study Design and Duration:** The study comprised 761 children up to 5 years old who were presented at the outpatient department (OPDs) and were admitted to Tertiary care hospitals in district Dera Ismail Khan, Lakki Marwat and Tank from January 2022 to January 2023.

**Sample Size:** The study included 488 boys (64.12%) and 273 girls (35.87%), diagnosed with LRTIs.

**Inclusion and Exclusion Criteria:** The patients were initially screened out based on the clinical manifestations of cough, tight chest, dyspnoea, wheezing, shortness of breath, fever, weakness and infected chest and were confirmed through X-rays, pathological investigation and microbiology.

All the patients of different ages (upto 5 years) and sex exhibiting the clinical signs of LRTIs, admitted in the pediatric wards were included in this study while, the exclusion criteria were maintained for patients with a previous history of structural abnormalities of the respiratory tract (like cleft palate), hypersensitivity, minor respiratory symptoms, age above 5 years and already receiving treatments.

**Study Tools and Statistical Analysis:** The data pertaining to the demographics (age, weight, gender, socioeconomic status and locale, etc), history, clinical manifestations, pathological, radiological, etc were collected and compiled on MS Excel Sheets (MS office, 2007). The collected data were statistically analyzed through Means+Standard Deviation and percentages of the continuous variables and the comparison of treatments was done at SPSS software Version-20 utilizing Chi-square and One-way ANOVA tests, by keeping  $p < 0.05$  as the significant proportion and  $p \geq 0.05$  as Non-significant relationship.

**Ethical Approval:** The study was duly conducted under ethical norms, records of the patients and their parents were maintained in confidentiality, and the informed consent protocols were implemented by their volunteer involvement in the study. Moreover, the study was also approved by the Board of Ethical Review Committee of the District Health Office of the concerned districts.

**RESULTS**

Lower respiratory tract infections attack the airways (below the larynx), including the trachea and alveolar sacs. It is related to infants and young children more frequently. Therefore, this study was conducted on children less than five years to determine their LRTI epidemiological trends. Our findings revealed that the LRTI showed the highest incidence in infants ( $p < 0.05$ ) less than a year age (327/761), followed by subsequent age patterns of 1-2, 2-3, 3-4 and 4-5 years with the frequency of 42.96, 23.91, 13.66, 10.11 and 9.329%, respectively. Female children (57.03) in our study were most often infected ( $p < 0.05$ ) with LRTIs than male (42.96%) kids, respectively. Significantly lower weighed children were more prone to the infection ( $p < 0.05$ ) of weight less than 10 Kg with an incidence of 64.52% and high proportion ( $p < 0.05$ ) of the infected kids belonged to poor families (85.41%) of mostly ( $p < 0.05$ ) rural area (60.84%) (Table 1).

Table 1: The demographic characters of the affected pediatric patients

S. No	Demographic parameter	No. of children (n)	Frequency (%)	p-value
1	Age			0.00001*
	<1 year	327	42.96	
	1-2 years	182	23.91	
	2-3 years	104	13.66	
	3-4 years	77	10.11	
4-5 years	71	9.329		
2	Gender			0.001772*
	Male	327	42.96	
	Female	434	57.03	
3	Weight			0.00001*
	<10 Kg	491	64.52	
	10-20 Kg	196	25.75	
	>20 Kg	74	9.724	
4	Socioeconomic status of their family			0.00001*
	Prosperous	111	14.58	
	Poor	650	85.41	
5	Locale			0.00001*
	Urban	298	39.15	
	Rural	463	60.84	

\*indicated that the value is significant at  $p < 0.05$

Table 2: The incidence of clinical manifestations in LRTIs

S. No	Clinical Manifestations	No. of Children (n)	Frequency (%)	p-value
1	Cough	715	93.95	0.00001*
2	Fever	601	78.97	
3	Tight chest	327	42.96	
4	Phlegm	540	70.95	
5	Shortness of breath	281	36.92	
6	Dyspnoea	121	15.90	
7	Wheezing	107	14.06	

\*indicated that the value is significant at  $p < 0.05$

Table 3: Area-wise distribution of LRTIs in children

Dera Ismail Khan n(%)	Lakki Marwat n(%)	Tank n(%)	p-value
311 (40.86)	178 (23.39)	272 (35.74)	0.007126*

\*indicated that the value is significant at  $p < 0.05$

The study of clinical manifestations of the infected pediatric patients revealed that they were significantly suffering from coughing (93.95%), followed by fever (78.97), phlegm (70.95%), tight chest (42.96%), shortness of breath (36.92%), dyspnea

(15.90%) and 14.06% (107/761) children manifested with wheezing sounds during infection (Table 2). The area-wise distribution of the incidence of LRTIs was also distinguished whereby District Dera Ismail Khan had the highest ( $p < 0.05$ ) number of cases (40.86%), followed by Tank and Lakki Marwat with the frequency of 35.74 and 23.39%, respectively (Table 3). The respiratory problems were studied in LRTIs in terms of the breathing in the infected children and it was seen that a significantly high proportion ( $p < 0.05$ ) of the children manifested dyspnea followed by bradypnea, apnea and hyperpnea with the incidence of 56.4, 7.6, 6.3, and 4.3%, respectively while 25.4% patients breathing rate was unaffected (Figure 1). The season-wise prevalence of LRTIs revealed that the incidence of LRTIs was maximum in the season of winter, followed by spring, autumn and summers (Figure 2).

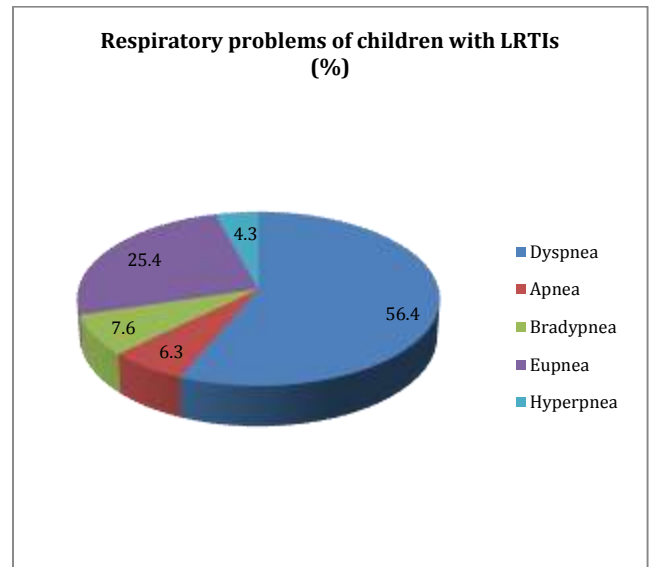


Figure 1: Breathing patterns of the LRTI-infected pediatric patients

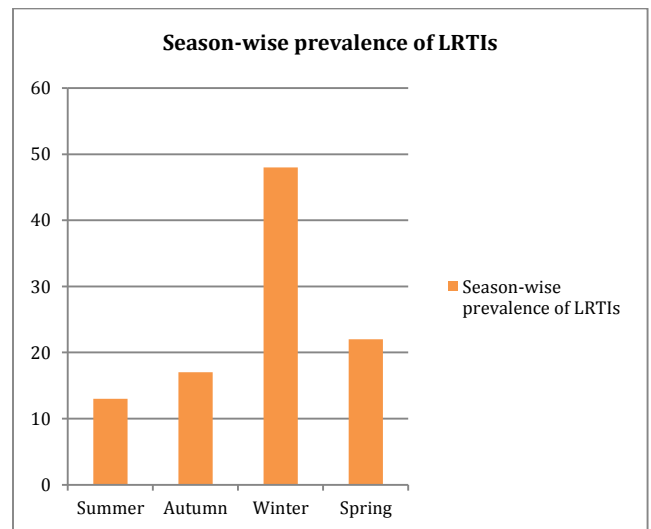


Figure 2: Season-wise distribution patterns of LRTI in children

**DISCUSSION**

Our findings revealed that the highest frequency of LRTIs was found in infants whereby 42.96% (327/761) of infants suffered from the infection. Our findings concurred with a study's conclusion that LRTIs constituted a considerable burden on Thai pediatric

community. Despite the implementation of the GAPP in 2009 by WHO in 2017–2021, the burden of LRTIs in Thai children requiring hospitalization in 2019 was comparable to that of 2010 (276,254). During 2015–2019, pneumonia was the leading cause of LRTIs, just as it was in 2010 in Thailand and other Asian nations. The most prevalent infection responsible for LRTIs was the virus <sup>2</sup>. The most common agents involved in LRTIs in children were the Influenza virus which affected 8.7% of children below 5 years, in Vietnam (Hassan 2014). The peak incidence of LRTIs in Thailand occurred between July and September, coinciding with the rainy season <sup>5</sup>.

A study revealed that the incidence of ARI in children 0–10 years of age was 5.9 (5.8–6%) per child-year, irrespective of the significant gender difference. However, the incidence of LRTI in children under the age of five was greater in males (0.43; 0.39–0.49) than in girls (0.31; 0.26–0.35) per child per annum. Boys had a 2.4 times more hospitalization rate than girls <sup>6-7</sup>. The peak incidence of ARIs occurred between 2-4 months aged infants <sup>8-9</sup>, while, others found that the peak incidence of ARIs occurred at 12 months of age <sup>10</sup>, the prevalence of ARI is approximately 25% greater in the first year of life than in the second. In conjunction with the findings of additional early cohort research conducted in rural Bangladesh <sup>6</sup> and a more recent Indian study, these findings showed that the peak of ARIs tended to occur sooner in less developed nations <sup>11-14</sup>.

A study reported 61.9% prevalence of LRTIs in children aged 1 year and the 31.4% prevalence in children aged > 1 y 5 y, while Munir investigated 840 pediatric patients (2 months to 5 years) with ARTIs, of which 539 (64.2%) were male and 301 (35.8%) were female <sup>14-16</sup>. Similarly, 1008 patients were reported with respiratory issues out of which 594 (58.9%) were males and 414 (41.1%), were female <sup>17</sup>. It was reported that LRTIs had a high hospitalization and fatality rate, particularly among children under 5 years old. The influenza virus was the most prevalent cause of pneumonia <sup>18-20</sup>.

## CONCLUSION

Children with LRTIs had a high rate of hospitalization. The influenza virus was the most prevalent agent responsible for pneumonia. The fatality rate was highest in children younger than 5 years old who had LRTIs. Therefore, public intervention to prevent LRTIs in children should be implemented prior to the seasonal spread of infectious diseases. The cohort developed as a result of this collaboration will give crucial data on the epidemiology of LRTI in children younger than 5 years old in Pakistan. Preliminary findings indicate that LRTI inflicted a major burden on this cohort's children. Additional data analysis would aid in elucidating the risk factors and social disparities associated with this disease.

**Conflict of Interest:** None

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